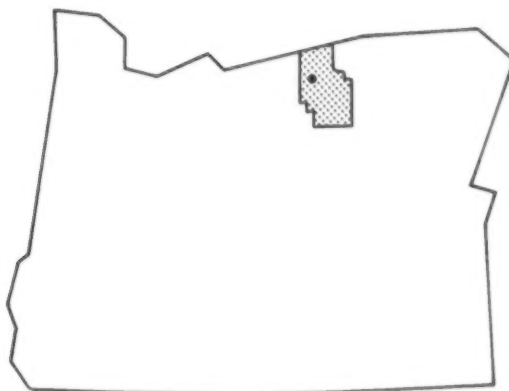


410176

FLOOD INSURANCE STUDY



CITY OF IONE,
OREGON
MORROW COUNTY



OCTOBER 1, 1980



federal emergency management agency
federal insurance administration

COMMUNITY NUMBER -410176

FEM 1-209

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Exhibit 2 - Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Ione, Morrow County, Oregon, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Ione to the regular program of flood insurance by the Federal Insurance Administration. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the study contractor, the Federal Insurance Administration, and the City of Ione in July 1977.

The results of this study were reviewed at a final community coordination meeting held on May 1, 1980. Attending the meeting were representatives of the Federal Insurance Administration, the study contractor, and the city. No problems were raised at the meeting.

1.3 Authority and Acknowledgments

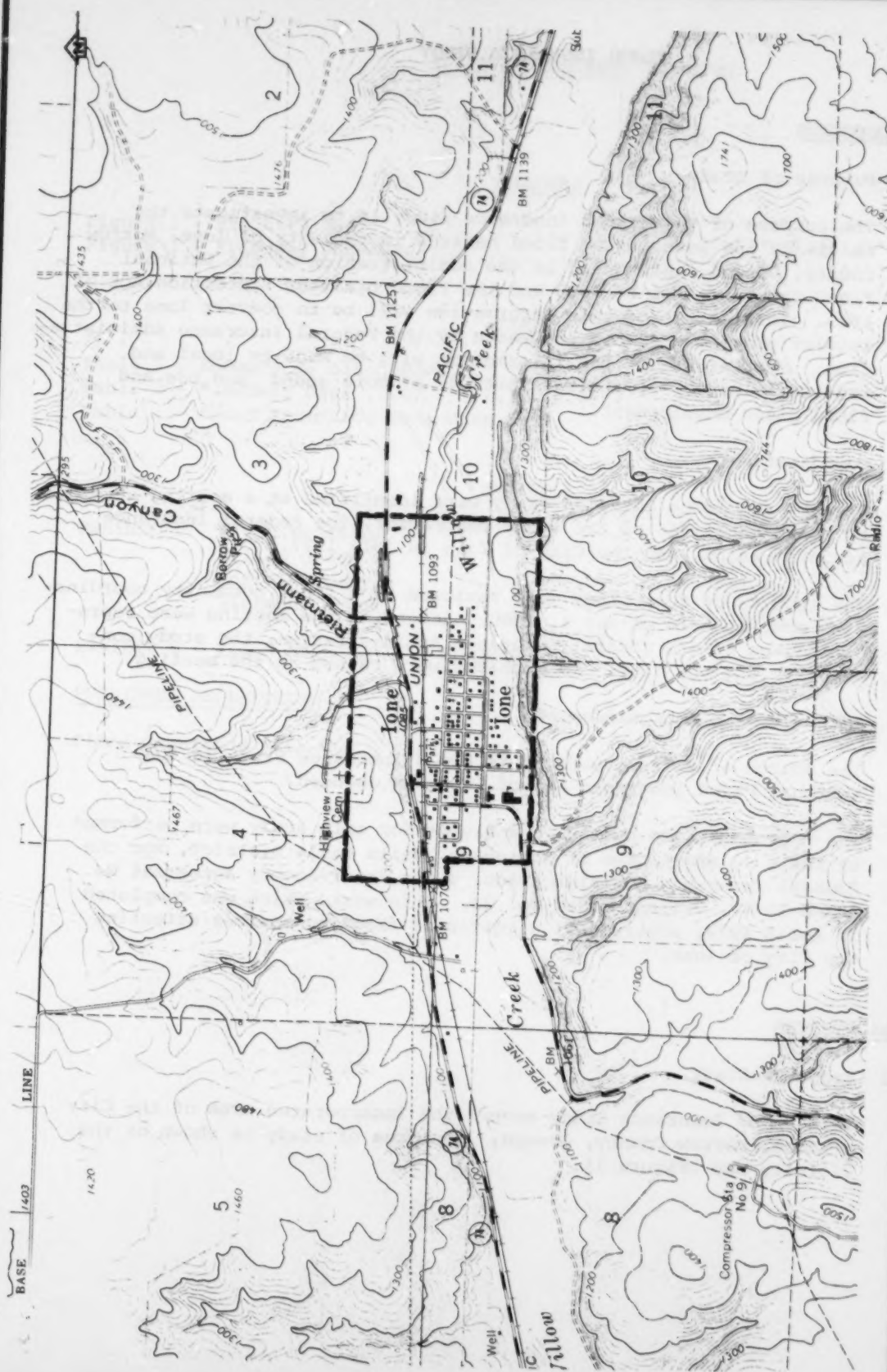
The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Walla Walla District, for the Federal Insurance Administration, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 32. This work, which was completed in April 1979, covered all significant flooding sources affecting the City of Ione.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Ione, Morrow County, Oregon. The area of study is shown on the Vicinity Map (Figure 1).

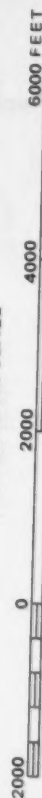


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CITY OF IONE, OR (MORROW CO.)

FIGURE 1

APPROXIMATE SCALE



VICINITY MAP

The areas studied by detailed methods were Willow Creek, Lorraine Canyon, Rietmann Creek, and a shallow flooding area to the north of Willow Creek.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1984.

2.2 Community Description

The City of Ione is located along Willow Creek, approximately 18 miles downstream from the City of Heppner and 9 miles northwest of the Town of Lexington, in western Morrow County, in northern Oregon. It is surrounded by unincorporated areas of the county.

Lorraine and Rietmann Creeks flow into Willow Creek at Ione.

Ione had a population of 426 in 1976 (Reference 1). The city lies in a steeply walled valley, where the topography of the developed portion of the city on the valley floor is flat. The surrounding hillsides rise rapidly from an elevation of 1080 to 1600 feet. The ground water table in the valley floor is high in areas immediately adjacent to Willow Creek (Reference 2).

The climate of the area is semi-arid. The average annual precipitation is from 10 to 14 inches. Summers are dry; much of the annual precipitation occurs during the winter and spring months. Average annual temperature is 50°F, with extremes varying from 100°F in the summer to 0°F and below in the winter (Reference 1).

Land use in the city is primarily residential with a small commercial area along Main Street.

2.3 Principal Flood Problems

There are three types of floods common to the Willow Creek basin.

A period of annual highwater occurs in early spring from melting snow, sometimes augmented by rainstorms. These flows seldom exceed channel capacities. Another type is a winter rain-snowmelt flood usually occurring from December through February and results from above-average snowfall on frozen ground, followed by warm rains. The third, and most damaging type of floods in the basin are violent summer thunderstorms with intense rainfall.

Streamflow records for the Willow Creek basin are very meager. Some flooding occurred in the Ione area in June 1888, June 1903, July 1918, August 1961, and February 1979.

The largest known flood in Ione occurred in August 1961, with an estimated discharge of 9000 cubic feet per second in Willow Creek downstream of Ione. This flood approximated a 30-year event.

2.4 Flood Protection Measures

There are no flood protection structures on the streams studied within the corporate limits of Ione. However, the basin has several areas where land treatment has been accomplished. These consist of detention ponds and contour ditches. The purpose of this treatment is to reduce field erosion, with a very small effect for reducing flood peak discharges.

The National Weather Service provides flash flood forecasts and warnings under its Flash Flood Alert, Watch and Warning Program. The Cities of Heppner, and Ione, and Morrow County, in cooperation with the National Weather Service and the Defense Civil Preparedness Agency, have established a Flash Flood Alarm System and Warning Plan.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each stream studied in detail in the community.

Because no streamflow records exist on Rietmann and Lorraine Canyons and no records on Willow Creek were compiled close enough to Ione to be applicable, the frequency curves were developed by derivation of synthetic floods. These curves were separated into two types of storms: the 6-hour thunderstorm and a 72-hour general rain and

snowmelt storm. These storms were regarded as independent and used for a composite frequency-curve. The floodflows were derived by applying precipitation excesses to the Snyder unit hydrographs for each basin. The excesses were determined by applying the appropriate loss rates to precipitation data from the National Oceanic and Atmospheric Administration, Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume VII (Reference 3), and U.S. Weather Bureau Technical Paper 49 (Reference 4). A detailed explanation of the methodology and data can be found in a U.S. Army Corps of Engineers hydrologic report (Reference 2).

Peak discharge-drainage area relationships for Rietmann Creek, Lorraine Canyon, and Willow Creek are shown in Table 1.

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (Cubic Feet per Second)			
		10-Year	50-Year	100-Year	500-Year
Rietmann Creek					
At Corporate Limits	3.02	293	1,235	1,600	2,180
Lorraine Canyon					
At Corporate Limits	0.30	42	192	254	347
Willow Creek					
At Ione	504.40	7,680	20,750	27,500	38,000

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of streams in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each stream studied in the community.

Water-surface elevations of floods of the selected recurrence intervals for all streams studied in detail were computed through use of the U.S. Army Corps of Engineers HEC-2 standard step-backwater computer program (Reference 5).

Cross sections for the backwater analyses for streams in the area were obtained by ground surveys. The below-water sections were obtained by field measurement. All bridges and culverts were surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Roughness values for the main channel and the overbanks of the study area ranged from 0.040 to 0.045.

The starting water-surface elevations were determined by normal depth calculations.

A normal depth analysis was used for the shallow flooding alluvial fan area at the mouth of Lorraine Canyon and Rietmann Creek.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

When the computed water-surface elevation is near the critical-depth elevation, unstable flow conditions can be expected. For cross sections at which unstable flow is expected, the elevations presented on the Flood Profiles (Exhibit 1) are the computed elevations at critical depth plus 40 percent of the velocity head at critical depth. The resulting depth is equal to 1.1 times critical depth for triangular channels and, therefore, is a conservatively high approximation for other channel shapes (Reference 6).

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage State and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Insurance Administration as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were developed photogrammetrically, using aerial photographs at a scale of 1:4800 (Reference 7).

The boundaries of the shallow flooding areas were developed photogrammetrically using aerial photographs at a scale of 1:4800 (Reference 7).

Flood Boundaries presented in this study are based on the computed water-surface elevations.

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity and increases flood heights, thus increasing flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment in order that the 100-year flood be carried without substantial increases in flood heights. As minimum standards, the Federal Insurance Administration limits such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced.

In high-velocity channels when flow is near critical depth, a relatively small change in specific energy can create a substantial change in water surface and make it impossible to obtain a 1-foot rise at each section from encroachment. Therefore, encroachments were generally set to produce a 1-foot increase in specific energy, which reflects the maximum potential water-surface elevation.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 2).

The floodways for Lorraine Canyon and Rietmann Creek are not shown because they are contained in the channel.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood boundaries are close together, only the floodway boundary has been shown.

FLOODING SOURCE		FLOODWAY				BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE ²	
Willow Creek									
A	0	780	5719	4.8	1072.2	1072.2	1073.1	0.9	
B	560	700	7542	3.6	1072.8	1072.8	1073.7	1.0	
C	1000	847	3490	7.9	1075.7	1075.7	1076.2	0.6	
D	1400	1142/1010 ^B	3692	7.4	1077.6	1077.6	1077.6	0.3	
E	1590	1014/974 ³	5440	5.1	1078.4	1078.4	1078.7	0.5	
F	2110	794	3003	9.2	1081.3	1081.3	1082.0	1.0	
G	2670	707	3833	7.2	1084.5	1084.5	1085.3	0.9	
H	3200	759	2978	9.2	1088.6	1088.6	1088.9	0.6	
I	3930	752	4457	6.2	1092.1	1092.1	1092.8	0.9	
J	4400	752	3249	8.5	1094.4	1094.4	1094.9	0.8	
K	4940	625	3546	7.8	1096.4	1096.4	1097.2	0.7	
L	5490	875	4668	5.9	1099.4	1099.4	1099.7	0.6	
M	5870	1032	5283	5.2	1100.3	1100.3	1100.9	0.6	

¹Feet Above Corporate Limits ²In Specific Energy ³Width/Width Within Corporate Limits

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TABLE 2

FLOODWAY DATA

WILLOW CREEK

FLOODING SOURCE			FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE ²	
Lorraine Canyon	0	117	67	3.8	1095.5	1095.5	1095.5	0.0	
	195	20	34	7.5	1100.5	1100.5	1100.5	0.0	
	495	16	31	8.1	1117.4	1117.4	1117.4	0.0	
	820	16	31	8.1	1145.3	1145.3	1145.3	0.0	
Rietmann Creek	0	55	164	9.8	1100.5	1100.5	1100.5	0.0	
	130	73	238	6.7	1102.8	1102.8	1102.8	0.0	
	230	30	132	12.1	1106.2	1106.2	1106.2	0.0	
	400	49	241	6.6	1108.3	1108.3	1108.3	0.0	
	580	68	202	7.9	1108.9	1108.9	1108.9	0.0	

¹Feet Above Mouth ²In Specific Energy

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TABLE 2

FLOODWAY DATA

LORRAINE CANYON-RIETMANN CREEK

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the specific energy the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

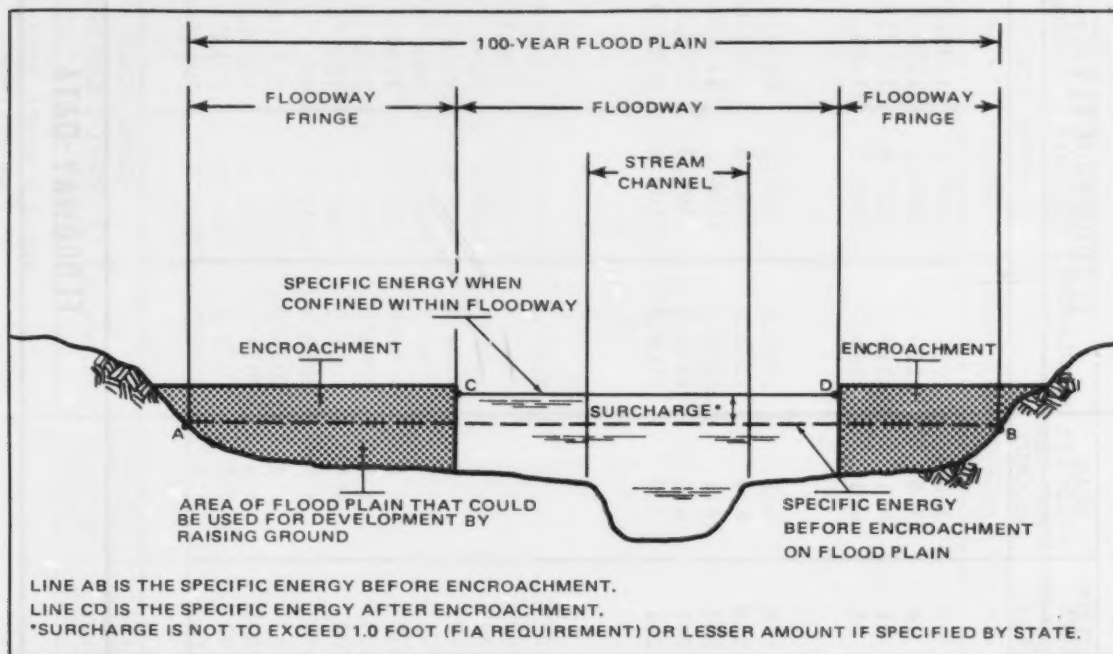


Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Insurance Administration has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Ione.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between
10- and 100-year Floods

Variation

Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Ione are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is the Federal Insurance Administration device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective Flood Hazard Factors, the entire incorporated area of the City of Ione was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A0:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no FHF's are determined.
Zones A3, A6, and A8:	Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to Flood Hazard Factors.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Willow Creek Reach 1	0001	-2.8	-0.7	0.9	030	A6	Varies - See Map
Lorraine Canyon Reach 1 Shallow Flooding	0001 0001	-1.7 N/A	-0.3 N/A	0.4 N/A	015 N/A	A3 A0	Varies - See Map Depth 2
Rietmann Creek Reach 1 Reach 2 Shallow Flooding	0001 0001 0001	-1.3 -3.9 N/A	-0.3 -0.7 N/A	0.4 0.9 N/A	015 040 N/A	A3 A8 A0	Varies - See Map Varies - See Map Depth 2

¹Flood Insurance Rate Map Panel

²Weighted Average

³Rounded to Nearest Foot

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FLOOD INSURANCE ZONE DATA

WILLOW CREEK-LORRAINE CANYON-RIETMANN CREEK

TABLE 3

flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C:

Areas of minimal flooding.

The flood elevation differences, Flood Hazard Factors, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Ione is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Insurance Administration.

The base flood elevation lines shown on the Flood Insurance Rate Map for Ione are based on the elevations as presented on the Flood Profiles (Exhibit 1).

6.0 OTHER STUDIES

Flood Insurance Studies have been conducted for Morrow County (Reference 8) and the Cities of Lexington (Reference 9) and Heppner (Reference 10) and are in general agreement with this study.

The U.S. Army Corps of Engineers prepared a Flood Plain Information report on Willow, Shobe, and Hinton Creeks at Heppner, and it is in general agreement with this study (Reference 11).

The Federal Insurance Administration's Flood Hazard Boundary Map for the City of Ione was consulted and is in general agreement with this study (Reference 12).

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

7.0 LOCATION OF DATA

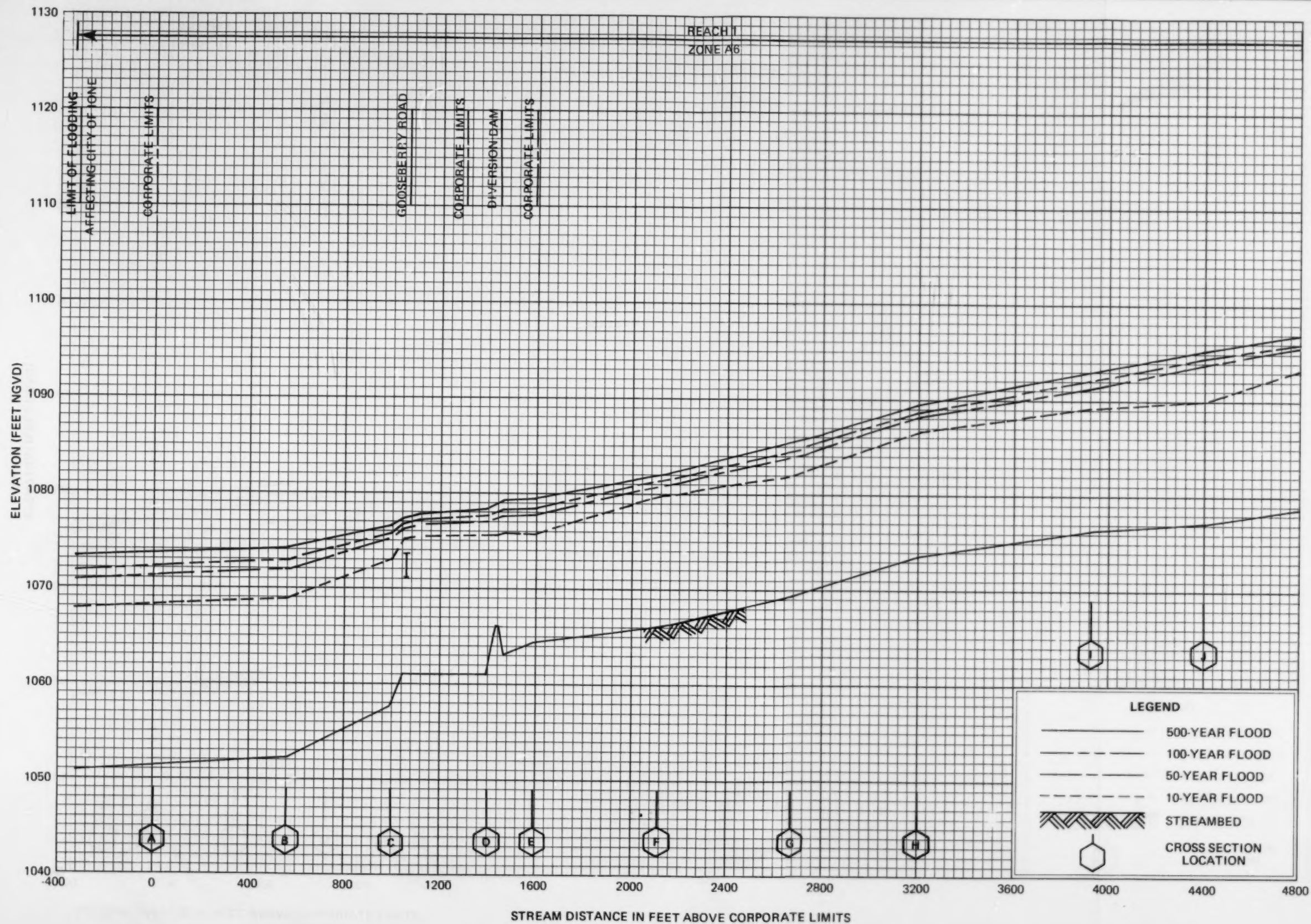
Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Insurance and Mitigation Division, Federal Emergency Management Agency, Federal Regional Center, 130 228th Street, SW., Bothell, Washington 98011.

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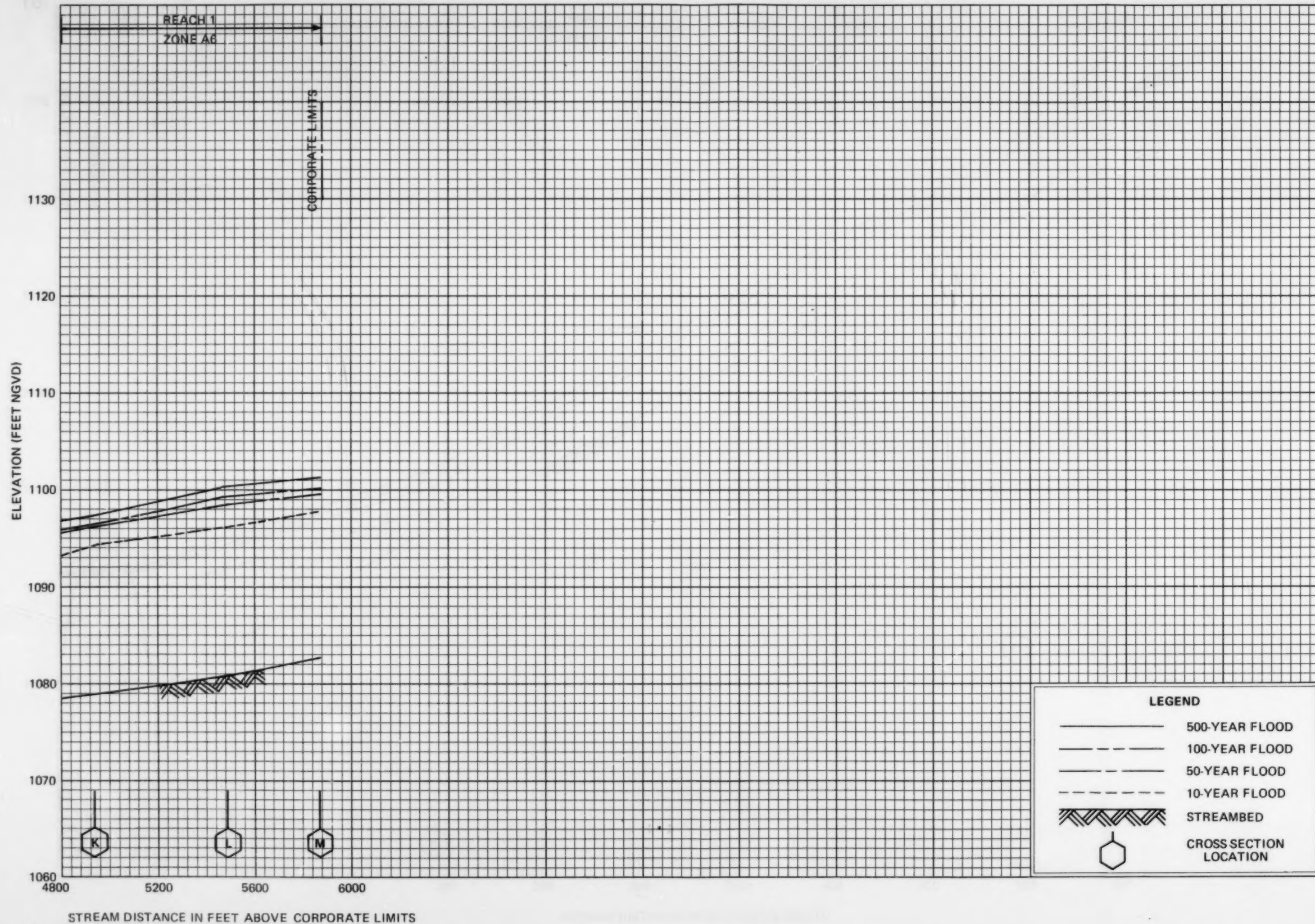
FLOOD PROFILES

WILLOW CREEK

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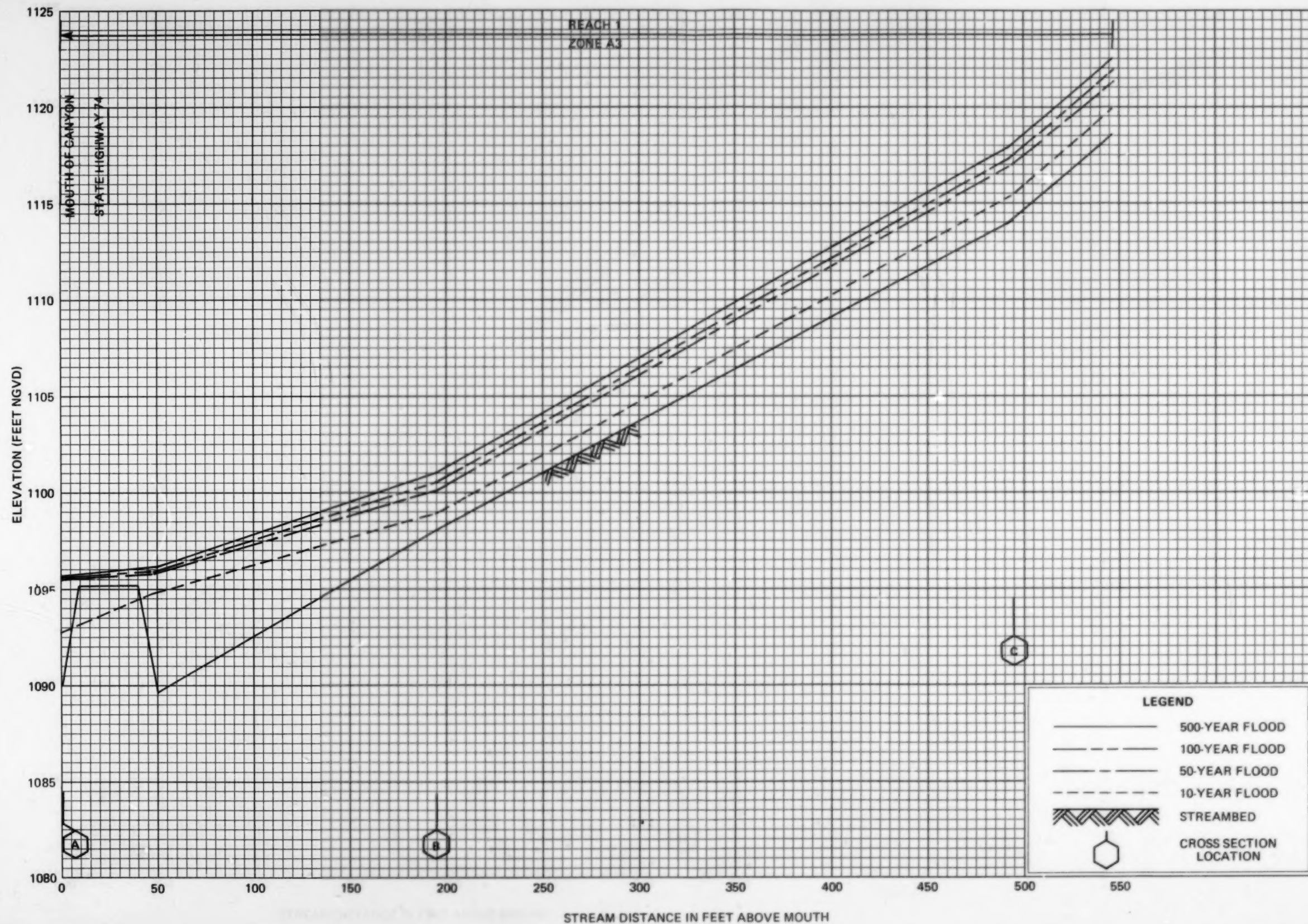
FLOOD PROFILES

WILLOW CREEK

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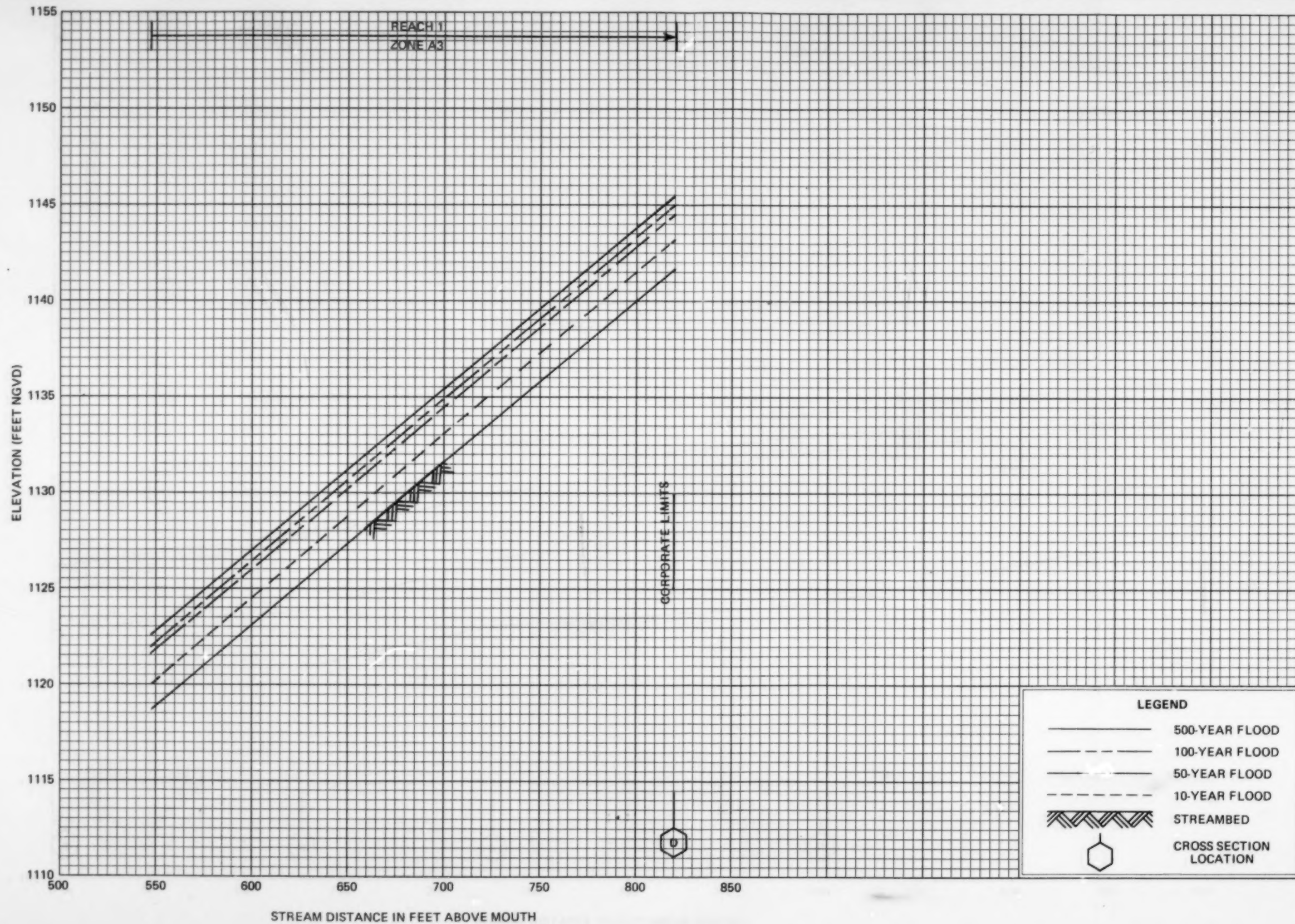
FLOOD PROFILES

LORRAINE CANYON

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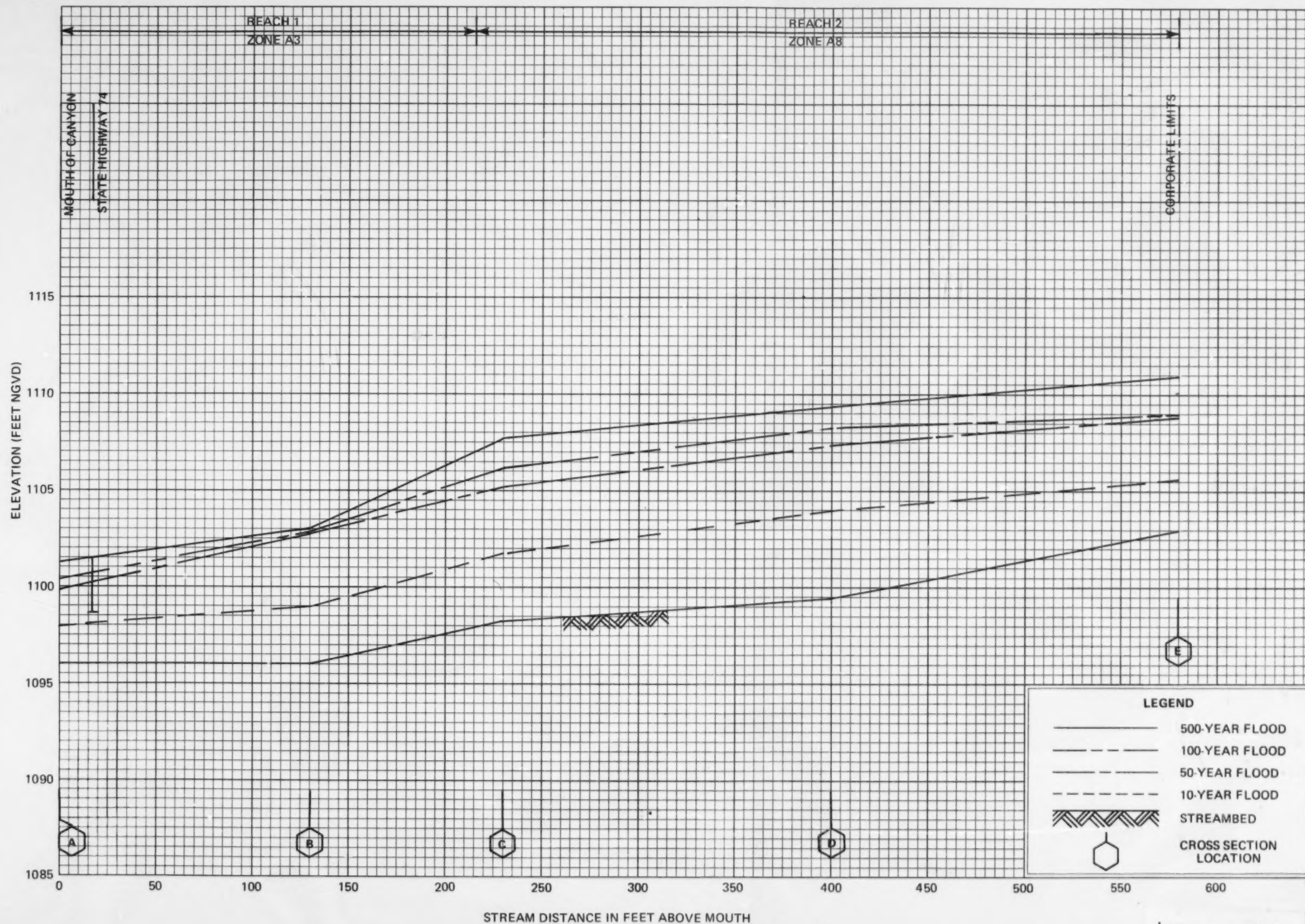
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